

APPENDIX

U. S. NUCLEAR REGULATORY COMMISSION  
REGION IV

NRC Inspection Report: 50-448/83-08  
50-449/83-08

Dockets: 50-448; 50-449

Construction Permits: CPPR-128  
CPPR-129

Licensee: Houston Lighting and Power Company (HL&P)  
P.O. Box 1700  
Houston, Texas 77001

Facility Name: South Texas Project Units 1 and 2

Inspection At: South Texas Project, Matagorda County, Texas

Inspection Conducted: April 11-15, 1983

Inspector: J. R. Boardman 5/13/83  
J. R. Boardman, Reactor Inspector  
Reactor Project Section B Date

Approved: W. A. Crossman 5/13/83  
W. A. Crossman, Chief  
Reactor Project Section B Date

Inspection Summary

Inspection Conducted April 11-15, 1983 (Report 50-498/83-08; 50-499/83-08)

Areas Inspected: Routine, announced inspection of construction activities including: deficient threads onsite fabricated anchor bolts; improper material of onsite-fabricated anchor bolts; training records; and review of previously identified findings. The inspection involved 29 inspector-hours onsite by one NRC inspector.

Results: Within the four areas inspected, no violations or deviations were identified.

Details1. Persons ContactedPrincipal Licensee Employees

- \*H. A. Walker, Project QA Manager
- \*J. L. Barker, Supervisor, Project Engineer
- \*D. F. Bednarczyk, QA Supervisor, Civil/Structural
- \*V. Reddy, Senior QA Engineer
- G. W. Steinmann, Site Engineer
- \*A. C. Von Nyvenheim, QA Specialist
- P. Reed, Manager, I.R.M.
- J. W. Soward, Supervisor, QC
- J. E. Soures, Senior QA Specialist

Other PersonnelBechtel Power Corporation (Bechtel)

- \*B. R. McCullough, Manager of Construction
- \*H. R. Reuter, Resident Project Engineer
- \*R. W. Miller, Site PQAE
- R. Schulman, Resident Engineer
- J. Roberts, Resident Engineer

Ebasco Services Inc. (Ebasco)

- J. Crnich, Construction Manager
- C. L. Hawn, Quality Program Site Manager

\*Denotes presence at exit interview held April 15, 1983.

2. Licensee Actions on Previous Inspection Findings

(Closed) Unresolved Item (8218-03). During a routine inspection in December 1982, the NRC inspector reviewed Brown & Root (B&R) Drawing 1-C-1552-5, "Reactor Containment Building Internal - Pressurizer Area - Dev. Elev. Unit 1." The NRC inspector was concerned that the installed 1 3/4" x 31" long bent anchor bolts fabricated of material to ASTM A-540 might have indeterminate mechanical properties. A subsequent review of documentation, which the manufacturer of the bolts supplied, shows that the bolts were heat treated after bending and, hence, meet design requirements relative to mechanical properties, in that heat treatment subsequent to bending provided a condition which meets A-540.

(Open) Unresolved Item(8210-01). During a routine inspection in June 1982, the NRC inspector identified the lack of documented instructions for tightening threaded fasteners to specifications such as ASTM/ASME A-36,

A-193, A-307, and A-540. The licensee has revised Drawing 5A01-0-C-0005, (Revision 10, dated December 14, 1982) to include a torque table for those anchor bolt materials where specific pre-load values are not identified. The NRC inspector's review noted that the table was incomplete, however, certain diameter bolts, such as 3/8", 1-5/8", and 2-1/4", are not included. This item will remain open pending further action by the licensee, and review by the NRC inspector.

### 3. Deficient Threads on B&R Site Fabricated Anchor Bolts

On October 27, 1978, the licensee notified the NRC of deficient threads on anchor bolts that were fabricated at the South Texas Project site. The final 10 CFR 50.55(e) report from the licensee was dated July 30, 1979, 20 months before the issue of B&R TRD 5A840SR163-A, "Anchor Bolt Integrity Verification Program," dated March 31, 1981. This TRD supersedes and replaces TRD 5A840SQ014-A, dated June 15, 1979. The only identified revision to this earlier TRD was a design change notice (DCN) dated June 25, 1979.

TRD 5A840SR163-A describes, in detail, information such as design bases and actions actually taken by B&R. It contains data relating to the B&R program in a succinct manner allowing a meaningful evaluation of the anchor bolt verification program.

a. The following are observations of the NRC inspector after a review of the TRD as it relates to deficient threads on B&R site fabricated anchor bolts, and selected B&R backup documentation such as nonconformance reports (NCR).

- (1) The TRD states that the deficient threads were made using "an adjustable die" without discussing the attributes of the die. Since the die was adjustable, each adjustment created a new production lot with potentially different dimensions, eliminating size homogeneity as a basis for any sampling.
- (2) A generic NCR for all site fabricated anchor bolts, NCR S-M421A, dated June 26, 1978, states that 86 shop work requests (SWR) were for anchor bolts for Category I (safety-related) applications. The eight NCR's listed in the TRD, Section 4.1.1.1, which show dimensional inspection, reflect inspection of only 25 SWR's. These NCR's (415, 456, 458, 1032, 1033, 1077, 1089, and 2111) document an in situ inspection of 780 safety-related anchor bolts. The licensee's final letter on this problem discussed above states that 628 safety-related anchor bolts were subjected to in situ dimensional measurements, and also that the locations measured were determined from marked-up drawings. These drawings are identified in the TRD (Section 4.1.1., page 5) but, to date, cannot be retrieved by the licensee. The TRD (Table 1) lists only 26 SWR's. Eight of these 26 SWR's (132, 503, 650, 652, 672, 792, 1050, and 1208) are not included on the 8 referenced NCR's. The eight NCR's inspected six

safety-related SWR's (1053, 1054, 1096, 1097, 1098, and 1258) not listed in Table 1 of the TRD. The NRC inspector is concerned that all applicable site fabricated anchor bolts were not inspected based on available documentation.

- (3) To resolve the problem of nonconforming threads, the licensee committed to the use of new thread cutting dies. The NRC inspector has identified no documentation showing that the new dies were used. Knowing the date the new dies were first used to manufacture anchor bolts is necessary to verify that all anchor bolts fabricated using the old dies were dimensionally verified.
- (4) Similarly, the NRC inspector has not been able to identify documentation which shows when, and specifically what, improved post-fabrication dimensional verification was actually incorporated in the program for site fabrication of anchor bolts to prevent a recurrence of this problem.
- (5) Based on available chronology, the in situ dimensional verification program (represented by NCR's 1032, 1033, 1077, 1089, and 2111) began about November 19, 1978 (the date of NCR S-M1032), and ended about March 29, 1979 (the date of NCR S-M2111). The entire program was completed prior to the initial issue of TRD 5A840S014-A, dated June 15, 1979. The NRC inspector has found no evidence to date that the in situ thread dimensional verification program was accomplished in accordance with documented procedures or instructions, including appropriate quantitative or qualitative acceptance criteria, or with necessary personnel training and qualification, to assure the accuracy and completeness of the resulting quality documentation. The NRC inspector has found no apparent documentation of original measurements with the identification of persons who took measurements, or the instruments used, so that personnel qualification and instrument calibration can be verified.

TRD 5A840SQ014-A stated that its purpose was for testing and evaluation of anchor bolts identified as having out-of-tolerance thread dimensions, or manufactured from improper material, and for reporting the results of such activity.

- (6) TRD 5A840SR163-A, in Table 5 (pages 12-14) shows the results of laboratory measurements of selected samples and anchor bolts and states that, "with the exception of the pitch diameter dimensions of samples 6, 9, 10, 11, and 12, and the minor diameter dimension of sample 9, the threads were found to be in compliance with ANSI B1.1, 'Unified Inch Screw Threads,' for either UN Series or UNC Series, Class 2A External Threads."

The NRC inspector reviewed Table 5 and found the following additional measurements apparently not in compliance with ANSI B1.1-1974.

- (a) Major diameter dimensions on samples 9 and 12.
  - (b) Minor diameter dimensions on samples 10 and 12.
- (7) B&R decided that all field measurements of pitch diameter dimensions were inaccurate and ignored these measurements. Their determination of fastener acceptability was based on bolt stress area, using the major diameter to determine this area. Proof tests were performed to provide acceptability of the 12 fasteners measured.
- b. The NRC inspector has the following concerns with the B&R actions and logic.
- (1) B&R did not verify the acceptability of site fabricated anchor bolts relative to external thread shear area, which is a function of pitch diameter of the external thread (see Observation a.(7)).
  - (2) The formula used by B&R for stress area is based on fasteners which meet the dimensional requirements of ANSI B1.1-1974.
  - (3) All sizes of site fabricated bolts were not tested, such as 1/2" and 2-1/4" diameter.
  - (4) The basis for testing for the TRD was those nonconforming bolts identified by previous measurements on NCR's 415, 456, 458, 1032, 1033, 1077, 1089, and 2111. These NCR's record only one measurement per dimension. There is no way of knowing if this measurement is the maximum, minimum, or neither. Laboratory measurements (TRD Table 5) and subsequent field sampling indicate variances in diameters as great as 0.069" (TRD Table 11, page 26, SWR 1219, Sample 2, measured OD (major diameter) 1.310"-1.379").
- NCR S-M1077 reports the initial field measurement of installed bolts on SWR 1219. The maximum OD reported was 1.375" (which logically must be sample 1 of Table 11, SWR 1219); the minimum was 1.349 (PAD A). The range of allowable major diameters for this size thread by ANSI B1.1.1974 is 1.3578"-1.3728". The measured dimensions shown in Table 11 varied from 0.006" above the allowable range to 0.0478" below. B&R stated in the TRD (Section 4.1.3.3.2, page 23) that the maximum deviation in Table 11 was less than 0.020".
- (5) This variance indicates inaccurate data from B&R's field measurements, and highlights the NRC inspector's concerns that the anchor bolts were fabricated from round bars which were out-of-round in excess of that allowed by either ASTM A-36 (by ASTM A-6) or A-193. There was no specific requirement to verify concentricity, nor documentation that verification was performed.

- (6) Eccentric bar used with threading dies (even acceptable dies) would produce eccentric bolts which could pass inspection using thread gages. Thread gages were identified by the licensee as an action taken to prevent recurrence of deficient threads.
- (7) As indicated in concern b.(4), above, the measurements taken during the B&R dimensional verification program were neither adequate nor accurate, and the program does not appear to have been prescribed in documented instructions and procedures (see Observations a.(5) and a.(6)).
- (8) Because of the apparent inadequacy of B&R field measurements, the samples selected for load tests were not the worst cases and, hence, installed bolts can exist which are unacceptable with respect to design requirements. No samples tested were as much as 0.048" below minimum major diameter, as was the case in concern b.(4) above, which represents an installed anchor bolt.
- (9) All site fabricated anchor bolts having potentially defective threads were not measured during the B&R dimensional verification program (see Observations a.(1), a.(2), and a.(3)).
- (10) The NRC inspector found that only one safety-related SWR used 1-1/2" A-36 bar of Heat 24552; this was SWR 1800, which fabricated 72 anchor bolts.

SWR 1800 was not included by B&R in TRD Table 1 listing safety-related bolts dimensionally verified; nor is there an NCR rejecting SWR 1800 dimensionally.

The SWR Summary for SWR 1800 shows 62 of 72 anchor bolts included in the material verification program, with the comment that the other 10 bolts were sent offsite. (TRD Table 2 appears to show nine of these ten bolts as samples for the laboratory dimensional verification program; Table 5 shows four measured; and Table 6 shows four load tested.)

TRD Section 4.1.3.2.1 states that the samples selected for load testing were ones that represented scrapped bolts to provide a safety factor. There is no documentation to support this statement for SWR 1800; nor has the NRC inspector seen such documentation for other samples.

An additional anomaly with SWR 1800 is found in TRD Attachment 5, which indicates, on data page 1, that 72 bolts from SWR 1800 are installed in RCB 1, Drawing 1-C-1505/1-C-1506. Data page 6 shows 72 bolts from SWR 1800 for RCB 2, Drawing 2-C-1543, as does data page 7.



- (11) Similarly, the TRD indicator in its attached B&R SWR Summary that Heat 54619, ASTM A-193 was only used for SWR 3352, sizes 7/8" x 21" and 7/8" x 31".

SWR 3352 is not shown in TRD Table 1, nor rejected on an NCR for dimensional verification of threads for site fabricated anchor bolts.

Based on available data, sample 4 in Table 2 (a 7/8" A-193 anchor bolt, Heat 54619) must be SWR 3352. Table 5 shows all dimensions acceptable. This fact does not agree with the TRD Section 4.1.3.2.1 which, as discussed above, states scrapped bolts were tested to provide a safety factor. In Table 6, these bolts are shown as passing a load test.

- (12) The NRC inspector also noted sample 2 of Table 2 of the TRD, which is shown as a 3/4" A-193 anchor bolt, Heat 75235. The B&R SWR Summary shows no SWR which used this heat of material. Table 5 shows acceptable dimensions, and Table 6 shows an acceptable load test.

The NRC inspector can find no basis for testing dimensionally acceptable fasteners, especially in light of TRD Section 4.1.3.2.1. The NRC inspector is also concerned that this is the 19th apparent example of anchor bolts being fabricated without an SWR.

Based on the concerns stated above, which resulted from the NRC inspector's review of B&R TRD 5A840SR163-A, the licensee's 50.55(e) item on deficient threads onsite fabricated anchor bolts will remain an unresolved item (8308-01) pending further review during a subsequent inspection.

4. Review of Licensee 10 CFR 50.55(e) Report Concerning Improper Anchor Bolt Material for Site Fabricated Anchor Bolts

- a. The NRC inspector continued his review in this area. The review consisted of the following actions:

- (1) The NRC inspector conducted an interview with a person still onsite who was an original member of one of the B&R teams who performed hardness tests onsite-fabricated anchor bolts in accomplishment of TRD 5A840S014-A. The person explained how he remembered the program, including the following pertinent facts:
- (a) He was given blank test data sheets (TDS) and he filled in descriptions, SWR numbers, heat numbers, etc., from identification, markings, and other visual observations at the time of testing. (There appeared to be a belief on the part of BPC personnel that such data was filled in from SWR's, and that

partially completed TDS's were provided to the hardness test teams. For loose bolts tested, such as in the embed yard.)

- (b) When a completed TDS showed hardness values outside the required range for the material tested, the TDS was returned to the hardness test team for retest and reverification of data reduction. This action was not identified by B&R in either TRD. This action also creates an enigma as to why B&R concern was not evidenced until January 1980 about data taken, and initially reverified, essentially during the first 2 weeks in August 1979. (The reverification program was not begun until January 1980.)
  - (c) The personnel taking hardness readings requested assignment of craft personnel to prepare by grinding, the surfaces being tested to improve flatness and surface finish. These requests were refused. Such imperfections, which were not removed, would give test results indicating the material as having lower hardness; hence, lower tensile strength than actual. This would provide a "fail-safe" situation under the B&R logic, but could mask problems with improper heat treating of A-193 bar, with the use of A-193 bar in lieu of A-36 for bent anchor bolts, and with A-193 anchor bolts welded to A-36 embed plates.
- (2) The NRC inspector also reviewed the originals (not available previously) of TDS's 172, 181, 362, 365, and 375. The copies of these TDS's (previously all that was available) appeared to have the SWR numbers obliterated. The review revealed the following:
- (a) TDS 172: The SWR number was 3169 but had been highlighted in yellow which reproduced as an obliteration.
- TDS 172 tested three loose 3/4" x 33" Type IV anchor bolts in MEAB 2 elevation 10'0", marked A-32, Heat 17950, SWR 3169.
- SWR 3169 fabricated eight 3/4" x 33" Type IV anchor bolts of Heat 37531.
- This is another example of as-fabricated anchor bolts showing an SWR and heat number different from that which is shown on the fabrication records (for SWR 3169.)
- In addition, the B&R SWR Summary under SWR 3169 shows no TDS, and states under comments "can not locate."
- (b) TDS's 181 and 365 both had their SWR number obliterated on their copies. Both originals showed SWR 1622.



TDS 181 tested 18 installed anchor bolts in MEAB 2 elevation 10'0" on August 27, 1989, identified as 3/4" x 46", Type IV, SWR 1622, Heat 17950.

TDS 365 tested two loose anchor bolts by the same team, at the same location, on the same date, with the same description.

TDS's 181 and 365 tested 20 anchor bolts, SWR 2622, Heat 17950.

SWR 1622 fabricated six 3/4" x 46" anchor bolt, of Heat 15878.

Here is another case of fabricated anchor bolts in the field having an SWR number and heat number different from manufacturing records (SWR). In addition, 20 anchor bolts were tested (18 installed, 2 loose), while only 6 were manufactured; another apparent case of anchor bolts fabricated without an SWR.

Additionally, TDS 045 shows SWR 1622 for six anchor bolts installed in MEAB 1, elevation 10'0", which could not be tested because the equipment had been set. This brings to 26 the anchor bolts identified to SWR 1622, by TDS's though SWR 1622 only fabricated 6.

- (c) TDS's 362 and 375 had their SWR numbers obliterated on their copies also. Both TDS's showed SWR 1702 on their originals.

TDS 362 and 375 tested loose 1/2" anchor bolts marked Heat 20268.

SWR 1702 shows Heats 15170 and 1-1192, but not 20268. This is another example of fabricated bolts showing different heat numbers; hence, different material from that shown on official manufacturing records.

In NRC Inspection Report 83-02, the NRC inspector identified 15 other examples where B&R documentation apparently disproves the B&R logic and methodology used to show that the problem of incorrect material utilized onsite-fabrication of anchor bolts had been resolved.

The three cases above are the first evidence that B&R had literally "highlighted" problems which appear to disprove their material verification program. They failed to identify these problems in their TRD 5A840SR163-A, and did not attempt to provide logic to explain why these problems did not invalidate their program.

Because of this evidence, this will remain an unresolved item (8308-02) pending further review by the NRC inspector during a subsequent inspection.

5. Required Quality Assurance Training Documentation

The NRC inspector requested documentation of training for B&R personnel performing hardness testing in accordance with TRD 5A840SQ14-A, "Anchor Bolt Integrity Verification Program," and CCP-24 "Test Anchor Bolt Materials," dated July 23, 1979, (See violation 8302-01). The licensee ultimately found these records, under the control of B&R, in personnel files. Apparently, B&R filed required quality assurance documentation of training in personnel files. This will remain an open item (8308-03) until the licensee has verified that all required training records have been obtained from B&R.

6. Unresolved Item

An unresolved item is a matter about which more information is required in order to determine whether it is an acceptable item, a violation, or a deviation. Two unresolved items are discussed in paragraphs 3 and 4 of this report.

7. Exit Interview

An exit interview was conducted April 15, 1983, with those licensee personnel denoted in paragraph 1 of this report. At this meeting, the scope of the inspection and the findings were summarized.

**INSPECTOR'S REPORT**  
Office of Inspection and Enforcement

T. R. BOARDMAN

REVIEWER

VIEWER  
W. A. CROSSMAN

INSPECTORS

LICENSEE/VENDOR	TRANSACTION TYPE	DOCKET NO. (8 digits) OR LICENSE NO. (BY PRODUCT) (13 digits)	REPORT		NEXT INSP. DATE	
			NO.	SEQ.	MO.	YR.
<u>HOUSTON LIGHTING AND POWER CO.</u> <u>P.O. BOX 1700</u> <u>HOUSTON, TX 77001</u>	X I - INSERT	05000498	P308	A		
	M - MODIFY	05000499	P308	B		
	D - DELETE			C		
	R - REPLACE			D		
	1	2	14	15	16	

PERIOD OF INVESTIGATION / INSPECTION							INSPECTION PERFORMED BY							ORGANIZATION CODE OF REGION/HQ CONDUCTING ACTIVITY (See EMC 0530 Manpower Reporting - Weekly Manpower Reporting for code)		
FROM			TO				X	1 - REGIONAL OFFICE STAFF				OTHER		REGION DIVISION BRANCH		
MO	DAY	YR	MO	DAY	YR	2 - RESIDENT INSPECTOR										
04	11	83	04	15	83	3 - PERFORMANCE APPRAISAL TEAM										
20	25	31											33	34	35	

REGIONAL ACTION (Check one box only)		TYPE OF ACTIVITY CONDUCTED (Check one box only)							
<input type="checkbox"/>	1 - NRC FORM 591	<input checked="" type="checkbox"/>	02 - SAFETY	<input type="checkbox"/>	06 - MGMT. VISIT	<input type="checkbox"/>	10 - PLANT SEC.	<input type="checkbox"/>	14 - INQUIRY
<input type="checkbox"/>	2 - REGIONAL OFFICE LETTER	<input type="checkbox"/>	03 - INCIDENT	<input type="checkbox"/>	07 - SPECIAL	<input type="checkbox"/>	11 - INVENT. VER.	<input type="checkbox"/>	15 - INVESTIGATION
<input checked="" type="checkbox"/>		<input type="checkbox"/>	04 - ENFORCEMENT	<input type="checkbox"/>	08 - VENDOR	<input type="checkbox"/>	12 - SHIPMENT/EXPORT		
		<input type="checkbox"/>	05 - MGMT. AUDIT	<input type="checkbox"/>	09 - MAT. ACCT.	<input type="checkbox"/>	13 - IMPORT		

36				37-38																											
INSPECTION/INVESTIGATION FINDINGS (Check one box only)				TOTAL NUMBER OF VIOLATIONS AND DEVIATIONS				ENFORCEMENT CONFERENCE HELD				REPORT CONTAIN 2,790 INFORMATION				LETTER OR REPORT TRANSMITTAL DATE															
A	B	C	D													NRC FORM 591 OR REG. LETTER ISSUED				REPORT SENT TO HQ. FOR ACTION											
X	X															1 - CLEAR															
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MODULE INFORMATION										MODULE INFORMATION																		
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TYPE	NUMBER	PHASE	MANUAL	CHAPTER	PROCEDURE	NUMBER	LEVEL	PRIORITY	DIRECT INSPEC- TION EFFORT IN STAFF HOURS EXPENDED THIS INSPECTION	PERCENTAGE COMPLETED TO DATE	STATUS	PHASE	MANUAL	CHAPTER	PROCEDURE	NUMBER	LEVEL	PRIORITY	DIRECT INSPEC- TION EFFORT IN STAFF HOURS EXPENDED THIS INSPECTION	PERCENTAGE COMPLETED TO DATE	STATUS	PHASE	MANUAL	CHAPTER	PROCEDURE	NUMBER	LEVEL	
B	1	2	3	0	7	0	3	8	A	1	0	0	1						A									
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\* CIRCLE SEQUENCE IF VIOLATION OR DEVIATION